NATURAL RESOURCES CONSERVATION SERVICE
MONTANA CONSERVATION PRACTICE STANDARD

WELL
(No.)
CODE 642

DEFINITION

A well constructed or improved to provide water for irrigation, livestock, wildlife or recreation.

PURPOSES

To facilitate proper use of vegetation on rangeland, pastures, and wildlife areas; to supply the water requirements of livestock and wildlife; to provide an adequate supply of water for conservation irrigation; and to provide for human use at recreation sites.

CONDITIONS WHERE PRACTICE APPLIES

Wells are limited to sites where the geology is favorable for the development of sufficient volumes of ground water to meet the irrigation requirements of the land on which the water is to be used. Wells may be the only source of water or they may supplement other sources. The water must be suitable for the purpose for which it is to be used.

Wells are applicable on rangeland, pastures, cropland, or for wildlife and recreation areas where present water facilities are inadequate or limited. The underground water supply must be of an adequate quantity and quality for the purpose to be served and able to be economically developed.

This practice standard does not apply to:

(1) temporary test wells drilled in order to determine water yield before a permanent well is installed; or

(2) permanent abandonment or decommissioning of wells.

CRITERIA

General: The suitability of the well site and the type of well installed shall be based on detailed geologic investigations, including test well drilling; on ground water assessment studies made by local, state, or federal agencies; or on reliable local experience. Design shall include ground water conservation measures, provisions for controlling contamination from one aquifer to another in the well, and methods for obtaining a maximum supply of sediment-free water.

Specifications shall provide criteria on the following:

casing--diameter, materials, length, wall thickness and strength of joints; screens--length, materials and slot size; filter packs; prepacked well screens; installation, alignment, grouting and sealing, and development of the well; access ports; disinfection and testing.

Unless the characteristics of the aquifer are known, specific well design such as screen location and slot size cannot be completed until the well is drilled.

Wells are covered by the Montana Codes Annotated (MCA), Title 37, Chapter 43, and the Administrative Rules of Montana (ARM), Title 36, Chapter 21. These regulations are issued by the Montana Board of Water Well Contractors and are consistent with this standard. All drilling shall be performed by well drillers licensed by the State of Montana.

Well Diameter: The diameter of the well shall be adequate to meet the yield capacity of the formation in relation to the nature and extent of the water-bearing area and to permit the installation of a pump to deliver the needed amount of water to the projected lift elevation.

Casing and materials: Casing shall be installed to furnish a direct connection between the surface and the aquifer; to seal out undesirable surface or shallow ground water; and to support the side of the hole through unstable, unconsolidated, or fractured earth materials, soft or weakly cemented formations, or chemically unstable formations.

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Casing and construction materials shall be selected on the basis of water quality, well depth, cost, borehole diameter, drilling procedure, and applicable statutes and regulations. Materials requirements shall be detailed in the Well Specifications.

Length of Casing and Wall Thickness: The maximum depth for well casing shall be based on critical collapse pressure as calculated by the Cleindeinst Equation in ASTM F480, Appendix X2. Depth, as used in this standard, applies to the difference in static head between the inside and outside of the casing. This can be determined either by making these measurements, or more conservatively, by using the total depth of the well.

The Well Specification shall address the dimensions and depth limitations for the casing material to be used.

Well Intake/Screen: The well intake shall be designed to stabilize the sides of the hole, keep sand out of the well, and facilitate flow into the well. The intake section of the well shall be designed after the well is drilled based on either sieve analysis or local experience. *Commercially manufactured well screens shall be installed in all wells completed in unconsolidated aquifers and in sedimentary aquifers that are weakly cemented or highly fractured.*

Filter packs shall be substituted for a commercially manufactured well screen under the conditions stated below.

Field perforated casing is allowed only for wells located in stable aquifers composed of clean, coarse gravel or well-consolidated rock or rock-like material.

The Well Specification shall address the size of the well intake or screen openings.

Filter Pack: Filter packs, not well screens, shall be installed if one of the following conditions occurs:

(1) presence of a poorly graded, fine sand aquifer;

(2) presence of a highly variable aquifer, e.g., alternating sand and clay layers;

(3) presence of a poorly cemented sandstone or similar aquifer;

(4) a requirement for maximum yield from a marginal aquifer;

(5) wells drilled using reverse circulation equipment.

Filter pack requirements shall be addresed in the Well Specification.

Prepacked Well Screens: Commercial prepacked well screens shall be substituted for a conventionally installed filter pack if the following conditions occur:

(1) presence of heaving or caving sands;

(2) presence of a silty or fine-grained aquifer;

(3) horizontal or angled wells.

Prepacked well screen criteria shall be addressed in the Well Specification.

Grouting and Sealing: In constructing, developing, or redeveloping a well, natural barriers to ground water movement between aquifers shall be preserved. Aquifers or strata penetrated during drilling operations which might impair water quality or result in cascading water shall be sealed.

Development: Before yield and drawdown tests are conducted, the well shall be developed to remove fines, drill cuttings, drilling fluids and additives.

Access Port: An access port shall be installed in the steel casing above ground level, to allow for unobstructed measurement of depth of the water surface, or for a pressure gage for measuring shut-in pressure of a flowing well.

Disinfection: All water wells shall be cleaned and disinfected immediately following their construction or repair in order to neutralize any contamination from equipment, material, or surface drainage introduced during construction.

Well disinfection shall be addressed in the Well Specification.

Sanitary Protection: Wells shall be located a safe distance from potential sources of contamination. If sources are severely limited, a ground water aquifer that is susceptible to contamination shall be adequately treated to be of a quality necessary for the intended purpose. A water supply intended for human

consumption shall meet local, county or state health regulations.

Each well shall be designed against contamination and be provided with a watertight cover or seal to prevent the entry of contaminated water or other objectionable materials.

Details pertaining to local water wells, such as depth, type of construction and vertical zone of influence, together with data on the geologic formations and porosity of subsoil strata, shall be considered in determining the safe allowable distances. The recommended minimum horizontal distance between the water supply and the source of contamination is presented in the following table.

Table 1

Recommended Minimum Horizontal Distance between Well Site and Source of Contamination

Source of Contamination	Minimum Distance
Waste treatment lagoon	300 feet
Waste disposal pond	300
Cesspool	150
Silo pit	150
Livestock and poultry yards	100
Privy, manure pile	100
Septic tank and leach field	100
Gravity sewer or drain (not pressure tight)	50
Gravity sewer or drain (pressure tight)	25
Property lines	10

Where possible, wells shall be located on ground that is higher than any source of contamination or flooding. Drainage that might reach the source from areas used by livestock should be diverted. Wells must be readily accessible for maintenance and repair and located a safe distance from both overhead and underground utility lines or other safety hazards.

If the well water is intended for human consumption, the casing shall be surrounded at the ground surface by a sanitary surface seal consisting of a reinforced concrete slab a minimum of 4 inches thick, which extends at least 3 feet in all directions.

CONSIDERATIONS

Test Wells: For sites located in areas with complex geology or where little information is available, or for wells with yields greater than 100 gpm, smaller-diameter test wells can be drilled to sample and test aquifer characteristics. These characteristics should include, but are not limited to:

(1) yield;

(2) size and gradation of aquifer materials for use in screen design;

(3) quality of water in terms of the intended use.

It is recommended that livestock be fenced from the wellhead a minimum of 50 feet.

Water Quality Testing: Sampling and testing of well water should be performed in accordance with all applicable federal, state and local requirements. These requirements vary according to the water quality standards associated with the intended use(s) of the water. In Montana, the Water Quality Bureau of the State Department of Health and Environmental Sciences or the county sanitarian should be consulted to determine:

(1) requirements for frequency of sampling;

(2) proper sampling techniques including handling and shipping;

(3) applicable testing protocols;

(4) recommendations for selecting certified testing laboratories;

(5) recommendations for remedial actions if needed.

PLANS AND SPECIFICATIONS

Plans and specifications shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended uses.

OPERATION AND MAINTENANCE

An operation and maintenance plan shall be prepared for use by the owner or others responsible for operating and maintaining the water supply system. The plan shall provide specific instructions for operating and maintaining the system to insure that it functions properly. It shall also provide for periodic inspections and prompt repair or replacement of damaged components. A guide to developing an operation and maintenance plan for wells is located in the NRCS Part 650,

Engineering Field Handbook, Montana Supplement, Chapter 52, page 52-26.

REFERENCES

* Well Planning and Design Guide in the Montana Supplement to the NRCS Engineering Field Handbook, including two white papers on well construction.
* NRCS Part 650, Engineering Field Handbook, Chapter 12, Wells and Springs.
* MT NRCS Environmental Technical Note: Environment No. 13, Assessing Water Quality for Agriculture and Domestic Uses, January 1982.
* Groundwater and Wells, Fletcher Driscoll, 1986, Johnson Filtration Systems.
* NRCS Private Rural Well Protection Video Training Series, 1992.